



"It seems to me that people comes with different need to push themselves, and make them look important. That is such an important factor that historians has to determine whether a story is bigger than the truth. I would like to point out however, that I am not like that at all. I always feel that I got more credit than I really deserved."

Severo M Ornstein - Mr .



Interviewed on June ??, 2005 in ***** (CA)
Born in October 13, 1930 in Pennsylvania, Philadelphia.

Study:
1951 B.A. (Cum Laude) - Harvard University
1952 Bachelor degree, Geophysics and Mathematics - U.C. Berkeley and Harvard University.

Work:
1953-1955: Geophysical experts at Gulf R&D Co. Pittsburg, Pa
1955-1983: Various computer-related position in research and instruction at several universities
1967-1976: Assistant Director of Arpanet Project at BBN (Bolt, Beranek & Newman)
1983- present: founder and chairman of Computer Professionals for Social Responsibility

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Do you remember when you had your first contact with a computer?



Yes, I remember very clearly. It was in 1953, and it had to do with climbing rope. I am a mountain climber and I was working as a geophysicist for a Gulf Oil company in Pittsburg and one morning when I went to work, I saw climbing rope in the back of a car in parking lot. I thought that it was nice that there is someone else who like climbing, so I asked the guard whose car it was and I looked him up. That guy, who became a friend of mine to this day, had been working at MIT on a Whirlwind computer. He told me about the work he has done, and it happens that at the time I was doing interpretations on seismic records, which needs correlating between those records. A lot of what I was doing seems to me as something that a machine can do, so when he introduced me to computer, one thing led to another and I suddenly find myself doing programs on Whirlwind computer. This was the earliest days of the computer and the programming language was native machine language.

What was your first contact/experience with Internet or ARPANET?

My first involvement with what became the internet was the RFP that came from ARPA that was circulated around. In 1967 I was casting about and I went to work for BBN in Boston because of Frank Heart. He was a friend and I had worked with him before. One night in early 1969, he handed me the RFP and said "why don't you look this over, see if you'd be interested in working on this". I took it home and when I came back, I said "well, looks like we could build it all right, but I can't imagine why anybody wanted such a thing."

So, that's funny now in retrospect, but it's also true in some measure. I was just an engineer, it was not a vision which I had at all. I wasn't aware of the vision of people like ... had, and that other people had. I mean there was some justification for the thing that was valid about it that time, but as far I could see, those justifications has tremendous road blocks in the way. There was a common fear of machine because of the economic, and there was a lot of talk about connecting all of the ARPA sites, so they could share resources, programs and so forth. But I don't think anybody envisioned what's happened at all. I thought that those visions that were stated, were somewhat unrealistic, and in fact they did not come to pass for many years, and by the time they came to pass, many other things has changed and we have been living in a different world entirely.

In your opinion, what are the key characteristics of Internet?



I can say that the important role it has on the world is gathering people, and serving as a tool for democracy. One of the clearest examples of this is during the time of President Clinton. The public was so tired at the republican movement to impeach the president due to his having an affair with a young woman, people are saying that we should move on, drop all of this and get on with the business of running the government. Some people in Berkeley started a website called moveon.org and it was designed specifically at that time to gather people who wanted to persuade the government to forget about the impeachment and move on. That has been the kind of usage which I hoped the internet would provide because I saw that the biggest threat facing the U.S. is the loss of democracy.

So for me, the most important characteristics, is the ability to provide a way for the people to communicate about social issues and I hope that will be more important than using it for commercial purposes.

What do you consider the most important milestones in the development of the network?

- 1970-1971 The building of the subnet, which is the sort of basic backbone net
- 1974 The development of Email
At that time, each host was being used in time sharing way and in the operating system of these hosts; there are ways so that users of terminals can send messages to each other, so there are mailboxes and such for local users. Since there is already ways to communicate between local users, it made it fairly simple to establish the way to communicate between users of different hosts. Ray Thomlinson saw this fact and he realized that an addressing scheme is needed in order to send messages to the right user at the right host, and that's where the @ symbol came from. So Ray initially used the net to send messages across hosts using similar operating system, but once that happens, another fellow from BBN wrote the first real email client program which even allows people using different operating system to communicate. I think that's very important because it turns out that e-mail was a very big thing, and nobody talked about email when they first start because they did not even think in those terms.
- 1991 The development of World Wide Web

How did you contribute to the development of the Internet?

In the very early days, the building of the subnet and making it work. It was a nice isolated job and I knew we could do that, as that was a very straightforward engineering.



The RFP was very detailed and everything was very well spelled out, but we changed the specifications from the RFP because we thought that what was written there was not the good way to do things.

BBN was a small company and the RFP is the kind that usually won by big companies, so we know that our proposal must be exceptionally better than everyone else in order for us to win. This is especially true because Larry Roberts, who was in charge with that RFP in ARPA, already knew some of us from the days that we were working in the Lincoln Laboratory, so he must be very careful not to show any kind of preference towards us in relation to that fact. It took us months to prepare the proposal and the management at BBN was appalled at the amount of time and money we put into writing that proposal. We actually designed a complete system in it so that by the time we actually got the project, we simply go ahead and did what we said we were going to do and it all worked. It was a risky thing to do, but then again it was also the only way that we can conceivably see to win. It took us a few months to prepare the proposal and we worked very hard.

After that, it was about building the next set of layers up, where the hosts have to figure out how to talk to one another using that layer. If we could put it online, if we could make it to pass messages, that was what everybody was desperate about.

I watched with wonders how the things evolved since then. I simply helped to build that first part, that's all. After that, I had nothing to do with the internet

Who are some key people in the development of Internet, leaders or trendsetters?

Frank Heart was the leader of the working group at BBN

David Walden, an engineer with exceptionally good memory.

Larry Robert, he is exceptionally bright, and one of the few people who are able to be both a manager and a researcher. If I must point out a single person whom think is the one that really creates the net, it will be him.

West Clark contributed much. One which I remember well is in a meeting, discussing how to connect the hosts. The original idea was to connect hosts directly, so that will create many redundant paths. West pointed out that these computers are different and each one of them will have to do something special to communicate with all of its neighbors. He suggested to use a small device in front of each computer and let these devices took care of communication and error correction, while each computer only needs to communicate with the device in front of it. These devices were later built and known as napal routers, and later on called IMPs.

Bob Kahn, at that time had been specialist of signal processing in MIT. He works together with me in testing the designs theoretically, and at



that time he actually did not understand computer and was learning a lot of that experience. He tends to take more credits than what he did.

Ray Tomlinson, for introducing the @ system to pinpoint a user at a particular machine when sending messages across networks.

Tim Berners Lee for creating the World Wide Web

Will Crowther, he was a superb machine language programmer. He built the first computer game that became the predecessor of the Dungeon and Dragons type of game.

Bob Taylor, he is not a technical person at all, but he had very good instincts about what was important to work on. He was like a general, who can't fight a war by himself, but knew which guys are the right ones to have as lieutenants in his army, and he assembled a very powerful army of people. He would direct people and they followed his direction even when they do not have any idea how to go that way. But, I think he rubbed people the wrong way because he was rather arrogant, and the fact that he did not actually do the work or write any paper about the work, as well as some other reasons, his name does not get mentioned anywhere.

Norm Abrinson Built the Aloha system in Hawaii, which was later adapted by Bob Metcalfe to create Ethernet for Local Area Network

Vint Cerf, but he was not really important at the time I was there. I guess he grow in importance over time.

Leonard Kleinrock, but we did not pay much attention of his work at the time because he was a mathematician and we were engineers.

Steve Crocker

Paul Baran

Lick Lyder

Two anecdotal situations

There was someone sitting in the middle of nowhere, and he wanted to be able to work just the way all the people who have local lines to their hosts would work, but he did not have any reason to go through the host. So, we built IMP that we called "Many Hosts". It had the very basic parts of the host computer in it, so we can connect terminals directly into the IMPs without going through the hosts, so people like this could communicate with terminals directly to the IMPs. In fact, we call these things Terminal IMP (TIP). These people thinks that because this is part of a big network, we are responsible for whenever their line went down, and no matter how much we tried to explain that their line was not our responsibility, they kept blaming us whenever their lines were not working. So, we built a system to test these lines. All of these lines were phone lines with modem, so there is a list of phone numbers to call, to verify that the lines are working. One day those guy at control center who were watching these things saw that one line is having trouble, so they called while listening into the line. They dialed, and they hear the "tweet" sound,



and suddenly there was a voice to the other end of the line, a man saying "it's you again!!! (slamming sound)". It turns out that they had the wrong phone number, and while they think they were calling a machine, actually they were calling a person. This kind of incident is of course common now, but that was about the first time it happens and this was an automatic caller that keeps on calling the poor guy.

At BBN then, there was an IMP because we were a member of the network, but we also have the control center that was responsible for the network. We needed to put a jumper at the bottom of this IMP, and it was running in the network at the time and we didn't want to take it down. So, everybody gathered around and because I was in charge of hardware, I got down on my hands and knees and the location was right down at the bottom of the machine. I saw the pins and I had to put the jumper on very carefully, but as soon as I touched the pins, it brought the machine down. So, the people who were responsible for networking rushed in and kick us off and put it all back up again. We realized that we didn't remember to put the jumper while the machine was down so another fellow stepped up, his name is Dan Parker and he was a junior guy, a student of mine. So he said "I am going to do it" and I shout "no way". He got down on his hands and knees, and he could look at the pins, and his hand was going up there trembling. He stopped shaking, he put it on, and then started shaking again, I couldn't believe it.

What do you think about the future of Internet?

My interest of it is really in the political agenda. I worried that the use of internet will be subverted by commercials, and the kind of use that I expected, the one for democracy, will be suppressed.

Personally I never understood the privacy thing because I don't feel that I have anything to hide. I go around the internet, sometimes sending critical messages and making fun of things and so forth, but I am prepared to stand behind it. However, I can see that some people will have their reasons to worry about it.

Do you see any technological trends?

Not really, I think basically they will simply get higher speed, because once you get a high enough speed, you can do things that you couldn't even think about doing at lower speed. There's also a trend towards artificial intelligence, but I am skeptical about it, I believe that we gain intelligence partly by evolution, not just by information. So I really doubt it that dumping the whole pool of information into a



bucket will create intelligence. Sure enough, there have been some results such as a responding machine, but it is way far from the kind of artificial intelligence that everyone imagined.

ADDITIONAL READING

PAPERS & BOOKS MENTIONED / RECOMMENDED

- **Where Wizards Stay Up Late**
- **Computing In the Middle Ages**
- **The Dream Machine**